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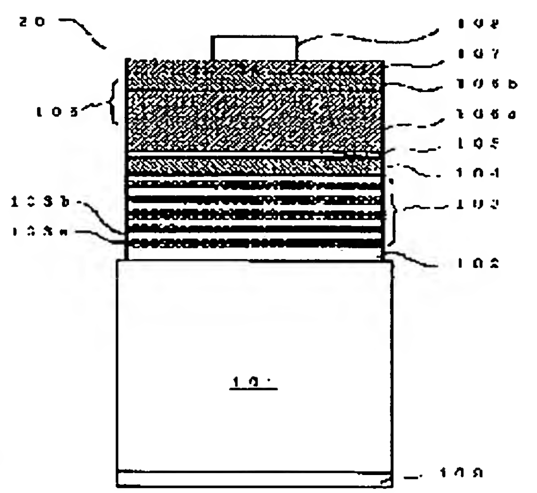
(54) AlGaInP LIGHT EMITTING ELEMENT WITH WINDOW LAYER

(57)Abstract:
PROBLEM TO BE SOLVED: To acquire an AlGaInP light emitting element of high brightness by providing a specified p-type clad layer, a light emitting layer and an n-type clad layer in a GaAs single crystalline substrate and providing a window layer consisting of zinc oxide thereon.
SOLUTION: P-type clad layers 104, 106 consisting of $(Al_aGa_{1-a})_xIn_{1-x}P$ ($0\leq a\leq 1$, $0<x<1$), a light emitting layer 105, an n-type clad layer and a window layer 107 of a polycrystalline zinc oxide are formed on a GaAs single crystalline substrate 101. In the process, the composition ratio (1-X) of indium of an AlGaInP layer is made 0.5, thereby obtaining good lattice-match to a GaAs substrate 101. It is desirable that zinc oxide is hexagonal wurtzite type crystal, a polycrystalline zinc oxide film is preferably orientated C-axially and the resistivity is made 1 × 103 O.cm or less. Although zinc oxide crystal shows n-type conduction in its so-called undoped state wherein impurities are not added intentionally, an n-type zinc oxide window layer 107 of lower resistivity can be formed by doping a group III element.



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CLAIMS

[Claim(s)]

[Claim 1] The light emitting device characterized by having p form cladding layer which consists of XIn1-XP (0<=alpha<=1, 0< X<1) on a GaAs single crystal substrate, respectively (aluminumalphaGa1-alpha), a luminous layer, and n form cladding layer, and having the window layer which becomes from the zinc oxide of the polycrystalline substance further at a it top.

[Claim 2] The light emitting device according to claim 1 to which the mixed-crystal ratio (1-X) of In is characterized by being 0.5.

[Claim 3] The light emitting device according to claim 1 or 2 to which a zinc oxide is characterized by mainly carrying out orientation in the direction of a c-axis as a hexagonal wurtzite mold crystal.

[Claim 4] a zinc oxide -- the -- a light emitting device given in any 1 term of claims 1-3 characterized by adding an III group element and having the conductivity of n form.

[Claim 5] the -- the light emitting device according to claim 4 characterized by III group elements being one or more kinds of elements chosen from boron, aluminum, the gallium, and the indium.

[Claim 6] A light emitting device given in any 1 term of claims 1-5 characterized by what a layer with lower carrier concentration is in a luminous layer side (it considers as A1 layer and carrier concentration is set to N1), and a layer with higher carrier concentration is in a window layer side including two-layer [n form cladding layer is different from in carrier concentration] (it considers as A two-layer and carrier concentration is set to N2).

[Claim 7] The light emitting device according to claim 6 characterized by for N1 being less than [5x1018cm -] three or more [1x1017cm -] in three, and N2 being three or less [3x1019cm -] or more [5x1018cm -] in three.

[Claim 8] The light emitting device according to claim 6 or 7 to which A two-layer is characterized by being 500nm or less in 5nm or more of thickness.

[Claim 9] an A1 layer dopant -- silicon -- it is -- an A two-layer dopant -- the -- a light emitting device given in any 1 term of claims 6-8 characterized by being VI group element.

[Claim 10] the -- the light emitting device according to claim 9 to which VI group element is characterized by being a selenium or a tellurium.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] It is related with the AlGaInP light emitting device possessing a window layer convenient for carrying out outgoing radiation of the luminescence from an aluminium phosphide gallium indium (AlGaInP) barrier layer to the exterior of high brightness.
[0002]
[Description of the Prior Art] It is in XIn1-XP (0<=alpha<=1, 0< X<1) plural mixed crystal. (aluminumalphaGa1-alpha) Especially 0.5In0.5P (0<=alpha<=1) that set an indium presentation ratio (= 1-X) to 0.5 (aluminumalphaGa1-alpha) a gallium arsenide (GaAs) single crystal and good grid adjustment -- having (Appl.Phys.Lett., and 57 (27) and (1990) --) It is used for the light emitting device (LED) or laser diode (LD) which carries out outgoing radiation of refer to the 2937-2939 page, for example, the red lamp color system, (refer to Appl.Phys.Lett., 64 (21) and (1994), and 2839 - 2841 pages). the light-emitting part of these light emitting devices -- light -- "-- in order to shut up and to obtain luminescence of high intensity using" effectiveness, usually consists of double hetero (DH) junction structures of a pn junction mold (refer to Appl.Phys.Lett., 61 (15) and (1992), and 1775 - 1777 pages).
[0003] It is only the function part which manages luminescence from which DH structure light-emitting part consists of a luminescence (activity) layer, the upper part, and a lower clad. A cladding layer is a barrier layer which pinches a luminous layer and is prepared in order to concentrate and carry out the radiative recombination of an electron and the electron hole in the limited field (inside of a luminous layer). In order to cause the recombination of a carrier (carrier) with sufficient convenience in a luminous layer field, a cladding layer enlarges a band gap (band gap) and consists of luminous layers. For example, a luminous layer is constituted from 0.5 (aluminum0.2Ga0.8) In0.5P, and DH structure which sets a cladding layer to 0.5(aluminum0.7Ga0.3) In0.5P is indicated (refer to Appl.Phys.Lett., 58 (10) and (1991), and 1010 - 1012 pages).
[0004] In the conventional XIn(aluminumalphaGa1-alpha)1-XP light emitting device, in order to diffuse the component operating current above DH structure light-emitting part extensively to a light-emitting part, it has been usually to arrange the aperture (window) layer which also bears the duty of current diffusion (refer to SPIE, Vol.3002 (1997), and 110-118 pages). Since a window layer is a crystal layer laid in order to expand luminescence area, it is desirable to constitute from a crystal layer of low resistance as much as possible. Moreover, in order to arrange a window layer in the direction of ejection of luminescence, it cannot absorb luminescence from a luminous layer easily, and needs to constitute it from a big semiconductor material of a transparent band gap to luminescence. Conventionally, the example which constitutes a window layer from an aluminum-arsenide gallium crystal (AlCGa1-CAs:0 <=C<=1) is indicated (above-mentioned Appl.Phys.Lett., 58 (1991) reference). Moreover, the example constituted from gallium phosphide (GaP) is also known (J. refer to Electron.Mater., 20 (1991), and 1125-1130 pages). the organic metal pyrolysis vapor growth (MO-VPE) which the thickness of the GaP crystal layer used as a window layer is about 10 micrometers to several 10 micrometers (above SPIE, Vol.3002 reference), and is the general growth approach of a XIn1-XP crystal layer therefore (aluminumalphaGa1-alpha) -- if it compares with law, it is formed of the halogen (halogen) or Hydride (hydride) VPE which a thick film can form simpler.
[0005] In addition to the group-III-V-semiconducter ingredient, the laminating configuration which arranges a transparent oxide crystal layer above a light-emitting part is also indicated. For example, in the American patent No. 5,481,122, indium oxide and a tin (indium-tin oxide: abbreviated name ITO) layer are arranged on p form ohmic contact layer. Moreover, a means to prepare indium oxide, tin oxide, a zinc oxide, and a magnesium-oxide coat so that the contact layer which consists of the Lynn-ized gallium arsenide (GaAsP), gallium phosphide (GaP), a gallium phosphide indium (GaInP), or gallium arsenide (GaAs) may be covered is indicated (refer to JP,11-17220,A). Drawing 4 is the cross section of the conventional AlGaInP light emitting device possessing the conductive oxide film. The conductive oxide film 52 has composition prepared on the contact layer 51 which it

had on the up cladding layer 106.
[0006]
[Problem(s) to be Solved by the Invention] AlCGa1-CAs has the good lattice matching relation to XIn (aluminumalphaGa1-alpha)1-XP which constitutes a cladding layer, and has the advantage which can form a window layer with few crystal defects, such as a misfit (misfit) rearrangement. However, the AlGaInP light emitting device which prepared AlCGa1-CAs of the high aluminum presentation ratio (= C) exceeding about 0.5 as a window layer requires special technical means, such as a passivation (passivation) technique, in order that forward voltage may be changed with time and may prevent this under the environment of heat and high humidity.
[0007] Moreover, although external luminous efficiency can be raised several times if a window layer is constituted from GaP, from stacking fault affinity with XIn(aluminumalphaGa1-alpha)1-XP, it will come to form a good GaP crystal layer, and the life of a light emitting device will be shortened. Moreover, in order to raise the ejection effectiveness of luminescence and to form the GaP crystal layer of a thick film, a different membrane formation technique from a cladding layer or a luminous layer is needed, and the production process of a light emitting device becomes complicated.
[0008] Moreover, in the conventional AlGaInP light emitting device equipped with the transparence oxide layer, the oxide layer is prepared through the contact layer which consists of GaAs etc. However, if it compares with 0.5In0.5P which are the component of a general luminous layer (aluminumalphaGa1-alpha), since it is small, luminescence will be absorbed by the GaAs layer and the band gap (= 1.43eV) in the room temperature of GaAs will become disadvantageous to obtain the light emitting device of high brightness. Furthermore, even if resistivity only contacts the small ITO film to about ten to 4 ohm-cm extent at a contact layer and prepares, there is a problem that good ohmic contact is stabilized and is not acquired.
[0009] A zinc oxide (ZnO) is in the oxide crystal which similarly has the conductivity of low resistivity of about ten to 4 ohm-cm extent (refer to an electronic communication link informatics meeting technical study group report, Vol.99, No.63 (1999. 5.20.), and 83-88 pages). However, the requirements for a configuration and laminated structure as which an ohmic contact property good as a transparence window layer is operated about the zinc-oxide film are not indicated.
[0010] This invention clarifies the requirements for a configuration and laminated structure for constituting a window layer from a zinc oxide in view of the above-mentioned background, and it is in offering the AlGaInP light emitting device of high brightness.
[0011]
[Means for Solving the Problem] Artificers reached this invention, as a result of inquiring wholeheartedly that the above-mentioned technical problem should be solved. Namely, p form cladding layer to which this invention consists of XIn1-XP (0<=alpha<=1, 0< X<1) on [1] GaAs single crystal substrate, respectively (aluminumalphaGa1-alpha), The light emitting device characterized by having a luminous layer and n form cladding layer, and having the window layer which consists of a zinc oxide of the polycrystalline substance on it further, The light emitting device given in [2] [1] to which the mixed-crystal ratio (1-X) of In considers that it is 0.5 as the description, and [3] zinc oxides as a hexagonal wurtzite mold crystal [1] characterized by mainly carrying out orientation in the direction of a c-axis, or a light emitting device given in [2], [4] zinc oxides -- the -- a light emitting device given in any 1 term of [1] - [3] characterized by adding an III group element and having the conductivity of n form -- the [[5]] -- the light emitting device given in [4] characterized by III group elements being one or more kinds of elements chosen from boron, aluminum, the gallium, and the indium -- A layer with lower carrier concentration is in a luminous layer side including two-layer [[6] n form cladding layer is different from in carrier concentration] (it considers as A1 layer). A layer with the higher carrier concentration which sets carrier concentration to N1 is in a window layer side (it considers as A two-layer). carrier concentration is set to N2 -- a light emitting device given in any 1 term of [1] - [5] characterized by things -- [7] N1 is less than [5x1018cm -] three or more [1x1017cm -] in three. A light emitting device given in [6] characterized by N2 being three or less [3x1019cm -] or more [5x1018cm -] in three, [6] to which [8] A two-layer is characterized by being 500nm or less in 5nm or more of thickness, or a light emitting device given in [7], a [9] A1 layer dopant -- silicon -- it is -- an A two-layer dopant -- the -- the [[6] given in any 1 term of - [8] light emitting device and [10] / which is characterized by being VI group element] -- VI group element is related with a light emitting device given in [9] characterized by being a selenium or a tellurium.
[0012]
[Embodiment of the Invention] In this invention, p form cladding layer which consists of XIn(aluminumalphaGa1-alpha)1-XP (0<=alpha<=1, 0< X<1), a luminous layer and n form cladding layer, and the window layer of the zinc oxide which is the polycrystalline substance are formed on a GaAs single crystal substrate. In this case, about the presentation ratio (1-X) of the indium of an AlGaInP layer, good grid adjustment is acquired to a GaAs

substrate by being referred to as 0.5.
[0013] a zinc-oxide (ZnO) polycrystal layer -- the physical depositing methods, such as the usual RF spatter and a vacuum deposition method, and chemical deposition (CVD) -- it can form by law etc. Especially, the zinc-oxide crystal layer of the polycrystal which makes growth bearing 200 degrees C or more, then the <0001> directions (the so-called direction of a c-axis) of a wurtzite crystal mold is about obtained in the temperature of a deposit-ed at the time of deposition. Although the zinc-oxide crystal of a single crystal is also available, at the membrane formation temperature from which the zinc-oxide crystal layer of a single crystal is obtained, it is based on sublimation of a zinc oxide, and the continuous zinc-oxide film is stabilized and may not be obtained. In order to diffuse the operating current broadly, the polycrystal zinc-oxide film with a high continuity is more advantageous than the single crystal film which lacks in a membranous continuity. In addition, the zinc-oxide film of an amorphous object is also contained in the polycrystal zinc-oxide film.
[0014] In this case, in order to carry out orientation of the polycrystal zinc-oxide film with the priority to the direction of a c-axis and to diffuse the operating current superficially, it is desirable to make resistivity (specific resistance) into less than 1x103 ohm-cm. Such zinc-oxide film is obtained by setting the temperature of a deposit-ed as about 450 degrees C from about 250 degrees C at the time of window layer formation. If it is desirable that it is about 5nm or more as for the thickness of a window layer and about 5 micrometers is exceeded, surface surface smoothness will get worse and equalization in the luminescence side of luminescence reinforcement will fall.
[0015] although a zinc-oxide crystal presents conduction of n form in the state of the so-called undoping (undope) which does not add an impurity intentionally -- the -- if an III group element is doped, n form zinc-oxide window layer of low specific resistance can be formed more certainly. the [, such as aluminum (aluminum), a gallium (Ga), and an indium (In),] -- if an III group element is doped, n form zinc-oxide crystal layer to which conductivity sufficient as a window layer which makes specific resistance about 2 - 3x104 ohm-cm was given will be obtained. For example, aluminum dope zinc-oxide window layer can be formed if it carries out sputtering, using as a target the molding material which consists of the zinc oxide which contains aluminum impurity about two to 5% of the weight, for example. Moreover, it can form in the front face of such a target ingredient also by the laser ablation method which irradiates a laser beam. In this case, it is not necessary to necessarily limit a dopant to a kind. For example, a window layer can also consist of n form zinc-oxide crystal layers by which the both sides of aluminum and Ga were added. The specific resistance of a zinc-oxide crystal layer can be measured with the usual hole (Hall) effectiveness measuring method etc.
[0016] In this invention, the zinc-oxide window layer of the above-mentioned n form polycrystal is deposited on n form cladding layer which is 1 configuration layer of DH structure light-emitting part. Here, the cladding layer arranged in the direction which takes out luminescence on the luminous layer which consists of a monolayer, a single, or multiplex quantum well structure is called an up cladding layer. Moreover, an up cladding layer shall consist of 0.5(aluminumalphaGa1-alpha) In0.5P (0<=alpha<=1) of n form on the relation which achieves ohmic contact in n form zinc-oxide layer which accomplishes a window layer. Thus, if a window layer is prepared on an up cladding layer, without minding the contact layer which consists of the small ingredient of a band gap like the former, absorption of luminescence can be avoided and luminescence of high brightness can be obtained.
[0017] Even if it does not arrange the contact layer for acquiring ohmic contact into an oxide crystal like before, if it constitutes so that it may have two layers which are [cladding layer / n form] different in carrier concentration, among those n form zinc-oxide window layer is formed on a high carrier concentration layer, the ohmic junction between n form cladding layers can fully be attained. In order to form ohmic contact of low resistance, it is desirable for n form carrier concentration of a high carrier concentration layer to be required for three or more [about 1x1018cm -], and to be three or more [5x1018cm -] at least. If it is the high carrier concentration exceeding 3x1019cm-3 generally, surface surface smoothness will be disturbed, and good ohmic contact becomes being hard to be stabilized. as n form impurity at the time of forming n form (aluminumalphaGa1-alpha) 0.5In0.5P (0<=alpha<=1) layer of such high carrier concentration -- the [of element periodic law] -- the silicon (Si) belonging to IV group etc. -- the -- the selenium (Se) and tellurium (Te) belonging to VI group are desirable.
[0018] Moreover, the layer of the low carrier concentration contained in n form cladding layer is prepared in a 0.5(aluminumalphaGa1-alpha) In0.5P (0<=alpha<=1) luminous layer side. It is because n form impurity which exists so much will invade into a luminous layer, will worsen the steepness of a presentation of the junction interface of the conduction type of a luminous layer, carrier concentration or a luminous layer, and an up cladding layer and will make a luminescence property inferior, if the high carrier concentration layer which doped n form impurity so much is prepared in a luminous layer side. As for n form carrier concentration of a low carrier concentration layer, it is desirable that it is less than [5x1018cm -] three or more [1x1017cm -] in three. this carrier concentration -- the -- the [which cannot carry out thermal diffusion more easily from a viewpoint

which controls diffusion of n form impurity to a luminous layer although doping of VI group impurity can attain] -- it is desirable to use the silicon (Si) which is IV group impurity.
[0019] It is enough if it is 5nm or more as thickness of a high carrier concentration layer. In less than 5nm, it is difficult to form the film and a good ohmic contact property with n form zinc-oxide window layer is not acquired. the [which is contained in a layer when thickness exceeds 500nm] -- the total amount of VI group element increases -- ******** -- the [a lot of] -- VI group impurity invades into a luminous layer, and becomes the factor which degrades the property of a luminous layer. On the other hand, the thickness of a low carrier concentration layer is also a layer for controlling the amount of n form impurity contained in the high carrier concentration layer which trespasses upon the interior of a luminous layer. therefore, MO-VPE -- when it takes into consideration that the temperature which forms n form cladding layer by law is around about 700 degrees C, as for the thickness of a low carrier concentration layer, it is desirable to consider as the thickness exceeding about 0.5 micrometers. Moreover, the amount of n form impurity in the high carrier concentration layer diffused in a luminous layer can decrease, so that the thickness of a low carrier concentration layer is large. About the upper limit of thickness, although 10 micrometers is sufficient, for example, it is not desirable in taking growth time amount, if it is a thick film, and the holding time in hot growth temperature increasing, an opportunity for a dopant diffusing to a luminous layer increasing, and the presentation steepness of a junction interface with a luminous layer being spoiled etc.
[0020]
[Example] (Example 1) This invention is hereafter explained to a detail based on an example. Drawing 1 is the mimetic diagram of the light emitting device 10 concerning this example. Moreover, drawing 2 is the mimetic diagram showing the cross-section structure in alignment with broken-line A-A' of the light emitting device 10 shown in drawing 1 .
[0021] The short wavelength visible light emitting device 10 on the (Zinc Zn) dope p form (001)-GaAs single crystal substrate 101 Carried out the laminating one by one by the reduced pressure MO-VPE method. The Zn dope p form GaAs buffer coat 102, the lower cladding layer 104 which consists of Zn dope p form (aluminum0.7Ga0.3) 0.5In0.5P, the luminous layer 105 which consists of n form (aluminum0.2Ga0.8) 0.5In0.5P mixed crystal of undoping, And it produced from the up cladding layer 106 which consists of n form (aluminum0.7Ga0.3) 0.5In0.5P. Trimethylaluminum (CH3) (3aluminum), trimethylgallium (CH3) (3Ga), and trimethylindium (CH3) (3In) were used as the raw material of an III group configuration element, and diethylzinc (C2H5) (2Zn) was made into the zincky source of doping. In the lower cladding layer 104, membrane formation temperature was set into 730 degrees C, and thickness set carrier concentration to about 430nm abbreviation 3x1018cm-3. Moreover, membrane formation temperature of 105 of a luminous layer was made into 730 degrees C, thickness made to about 12nm, and carrier concentration was set to abbreviation 5x1016cm-3.
[0022] The up cladding layer 106 consisted of Si dope low carrier concentration layer 106a which sets carrier concentration to 7x1017cm-3, and Se dope quantity carrier concentration layer 106b which sets carrier concentration to 2x1019cm-3. The thickness of a low carrier concentration layer set thickness of about 1 micrometer and a high carrier concentration layer to about 50nm.
[0023] The window layer 107 which consists of ZnO of aluminum dope by the general RF-sputtering method on the up cladding layer 106 was made to put. The window layer 107 was constituted from an n form layer which makes specific resistance in a room temperature abbreviation 3x10-4 ohm-cm, and thickness set it to about 200nm. By the general analyzing method, it was shown in that the stacking tendencies of the zinc oxide which accomplishes a window layer 107 are the <0001> directions (C shaft), and a list that it is polycrystal.
[0024] On the zinc-oxide window layer 107, circular n form electrode 108 whose diameter which consists of aluminum is about 120 micrometers was formed using the general photolithography technique. After carrying out vacuum deposition of gold and the zinc alloy (2 % of the weight alloy of 98 % of the weight-Zn of Au(s)) all over the rear face of the GaAs substrate 101, suitable distance gold-ized (alloy) processing was performed at 420 degrees C for 2 minutes, and it made with p form ohmic electrode 109. The appropriate back, it judged for the chip according to individual of the abbreviation square which sets one side to about 350 micrometers, and made with the light emitting device 10.
[0025] When conduction of the current of 20mA (mA) was carried out in the forward direction between n form electrode 108 and p form ohmic electrode 109, luminescence of an almost equal red lamp color was obtained from the whole abbreviation surface of the zinc-oxide window layer 107. The luminescence wavelength measured with the spectroscope was about 620nm. Moreover, the half-value width of an emission spectrum is about 17nm, and luminescence excellent in monochromaticity was obtained. Forward voltage (@20mA) became about 1.9 volts (V). Moreover, luminescence reinforcement reached the about 60mm candela (mcd).
[0026] (Example 2) The case where the InP (AlGa) light emitting device possessing the Bragg (Bragg) reflecting layer is constituted from this example is made into an example, and this invention is explained to a detail.

Drawing 3 is the cross section of the light emitting device 30 concerning this example.
[0027] general reduced pressure MO-VPE which inclined 4 degrees in the <011> directions and which uses trimethylaluminum (CH3) (3aluminum), trimethylgallium (CH3) (3Ga), and trimethylindium (CH3) (3In) as the raw material of an III group configuration element on the Zn dope (100) p form GaAs substrate 101 -- the laminating of the (Magnesium Mg) dope p form GaAs buffer coat 102 was carried out by law. Next, the laminating of the Bragg reflection layer 103, the lower cladding layer 104 which consists of Mg dope p form (aluminum0.7Ga0.3) 0.5In0.5P, the luminous layer 105 which consists of n form (aluminum0.2Ga0.8) 0.5In0.5P mixed crystal of undoping, and the up cladding layer 106 which consists of n form (aluminum0.7Ga0.3) 0.5In0.5P was carried out. The Bragg reflection layer 103 carried out multistory [of Mg dope n form aluminum0.45Ga0.55As layer 103a which sets aluminum presentation ratio to 0.45, and the Mg dope n form aluminum0.45Ga0.55As layer 103b which sets aluminum presentation ratio to 0.90] five periods, and constituted it. The thickness of aluminum0.45Ga0.55As layer 103a is about 42nm, and the thickness of aluminum0.45Ga0.55As layer 103b could be about 49nm.
[0028] The thickness of the p form GaAs buffer coat 102 set to about 0.2 micrometers, and carrier concentration was set to abbreviation 3x1018cm-3. Both sides set carrier concentration of the configuration layers 103a and 103b of the Bragg reflection layer 103 to abbreviation 1x1018cm-3. The thickness of the lower cladding layer 104 set to about 0.8 micrometers, and carrier concentration was set to abbreviation 3x1018cm-3. The thickness of 105 of a luminous layer set to about 10nm, and carrier concentration was set to abbreviation 8x1016cm-3.
[0029] The up cladding layer 106 consisted of two-layer [of low and high carrier concentration]. Low carrier concentration layer 106a which was made to join to a luminous layer 105 and has been arranged consisted of Si dope n form (aluminum0.7Ga0.3) 0.5In0.5P which set carrier concentration to abbreviation 6x1017cm-3, and set thickness to about 1.7 micrometers. High carrier concentration layer 106a consisted of n form (aluminum0.7Ga0.3) 0.5In0.5P which set to abbreviation 1x1019cm-3 carrier concentration which doped Se to high concentration, and set thickness to about 100nm.
[0030] On the high carrier concentration layer 106, the zinc oxide window layer 107 was formed with the electron beam vacuum deposition method by using as a raw material the solid molding ingredient (pellet) which consists of the zinc oxide which makes aluminum weight content and contains 3 % of the weight and Ga 0.5% of the weight. According to the hall effect measuring method, the specific resistance of n form zinc oxide which constitutes a window layer 107 is abbreviation 4x10-4 ohm-cm, and thickness could be about 150nm. From the diffraction pattern by the electron-diffraction-analysis method, it was checked that a zinc-oxide layer is the polycrystal which carried out orientation in the direction of a c-axis.
[0031] n form electrode 108 and p form ohmic electrode 109 were formed like the publication of an example 1, and the light emitting device 30 was produced. When conduction of the component operating current was carried out to the forward direction, luminescence of the red lamp color which sets wavelength to about 620nm was obtained from the whole abbreviation surface of the zinc-oxide window layer 107. Moreover, the half-value width (FWHM) of an emission spectrum is about 18nm, and luminescence which is excellent in monochromaticity was brought about. The forward voltage at the time of setting a current to 20mA was about 2V. Luminescence reinforcement reached about 90 mcd(s).
[0032]
[Effect of the Invention] By this invention, the AlGaInP light emitting device of high brightness can be obtained.

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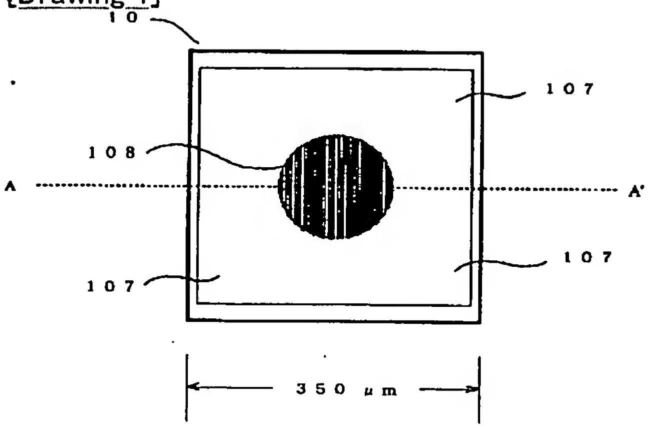
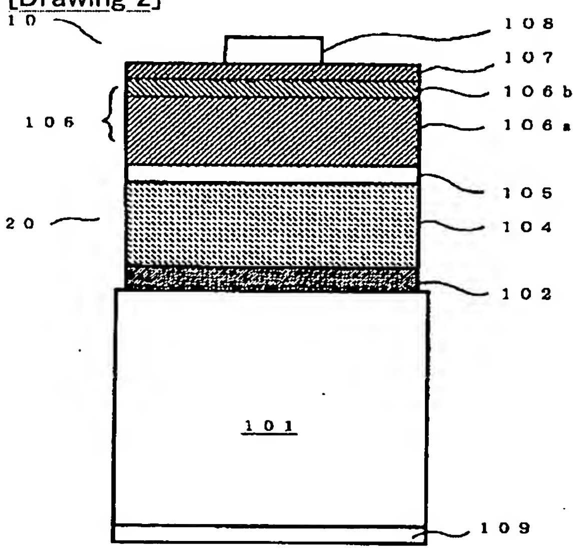
DRAWINGS

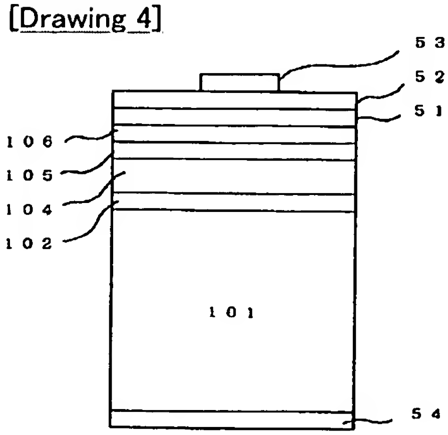
[Drawing 1]



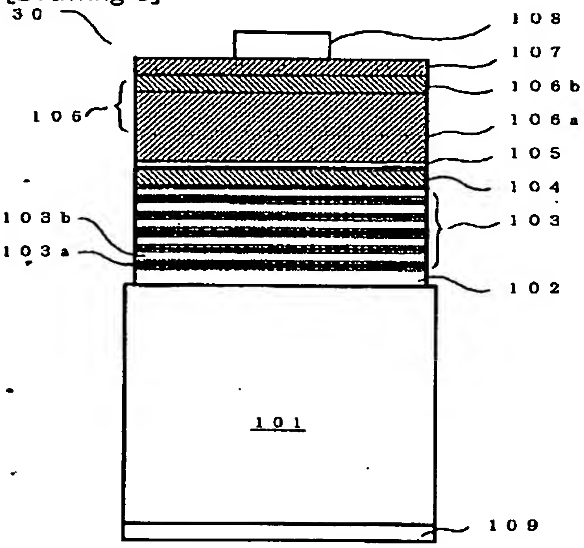
[Drawing 2]



[Drawing 4]



[Drawing 3]



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